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(51) INT CL<sup>6</sup>  
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(52) UK CL (Edition Q )  
**E1G G96B G96G G96L**

(56) Documents Cited  
**GB 2291452 A GB 2080373 A GB 1162434 A**  
**US 5240346 A**

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UK CL (Edition O ) **E1G G94A G94B G94L G94X G96A**  
**G96B G96L G96X**  
INT CL<sup>6</sup> **E02D 29/14**

(54) Abstract Title  
**A frame for a manhole cover**

(57) A frame 20 for supporting a manhole cover 22 comprises an upstanding peripheral wall 28; support means (40, 42) (Figures 3 and 4) extending inwardly from at least part of the wall for supporting the manhole cover 22; and an outer flange 30 extending outwardly from a lower part of the wall for anchoring the frame 20 in the ground; the outer flange 30 having over it's upper surface a plurality of protrusions or recesses 44 for enhancing the anchoring of the flange 30 in a bedding material and stiffening the frame 20 against bending. The protrusions may be at the corners only. The flange may have wider regions at the corners of the frame, when the flange is rectangular or square.

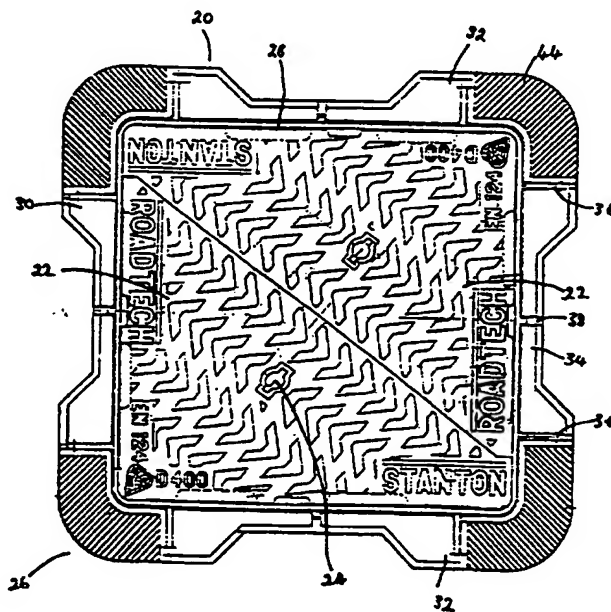


Fig. 2

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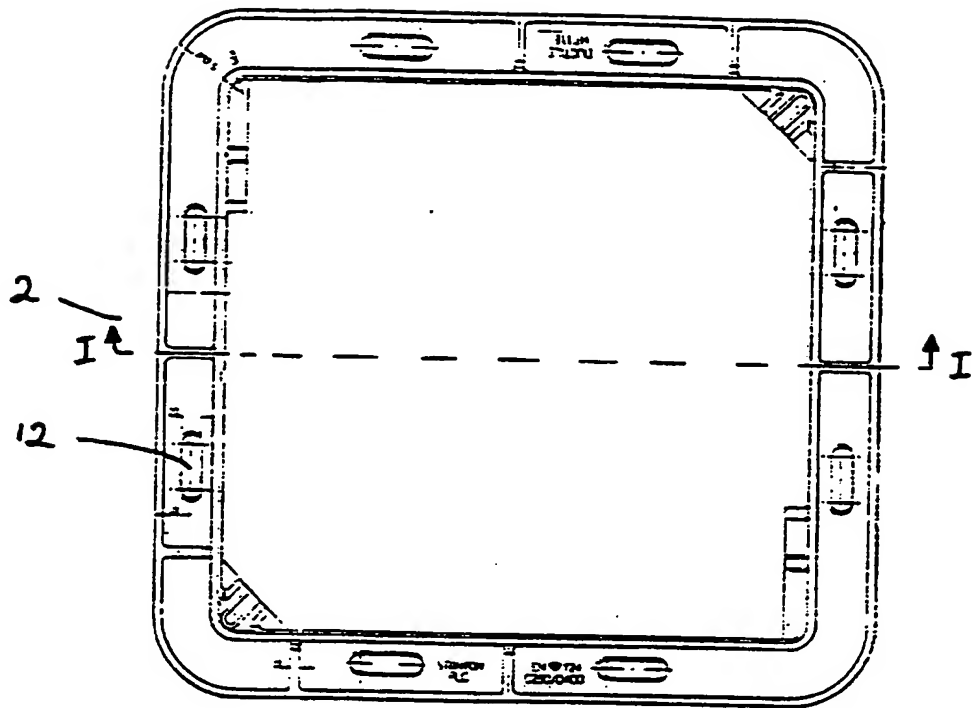


FIG. 1a

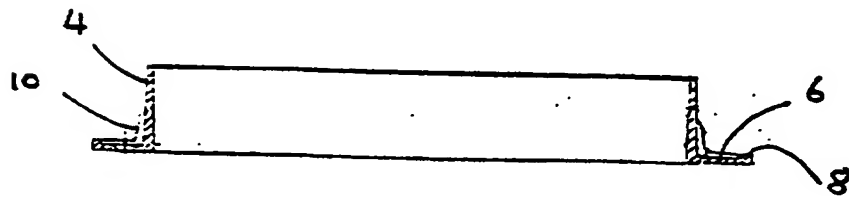


FIG. 1b

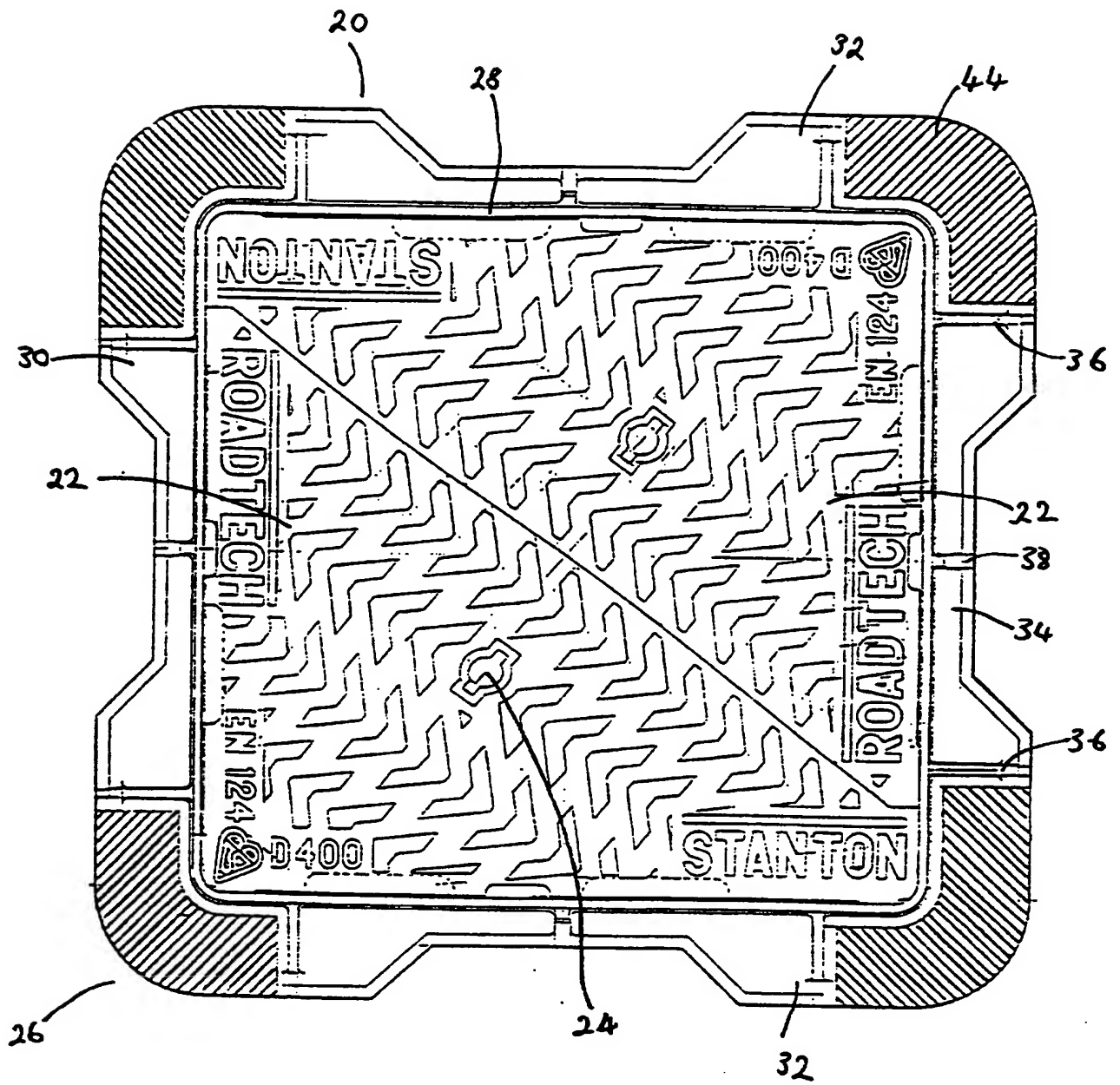


FIG. 2.

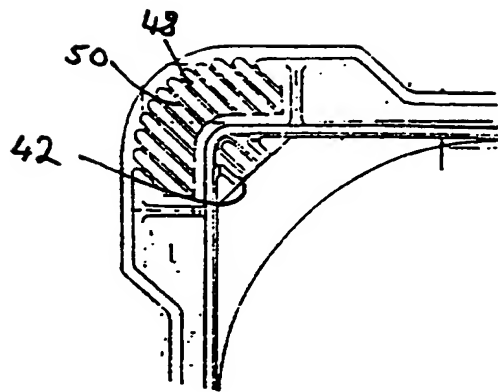


FIG. 4

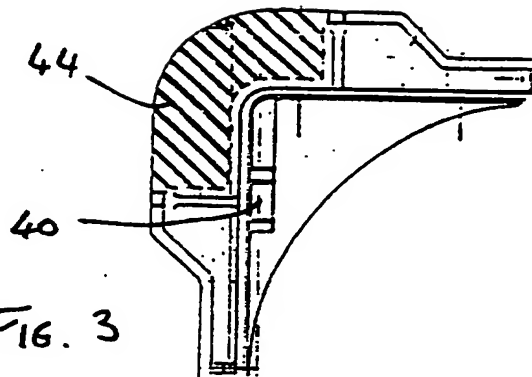


FIG. 3

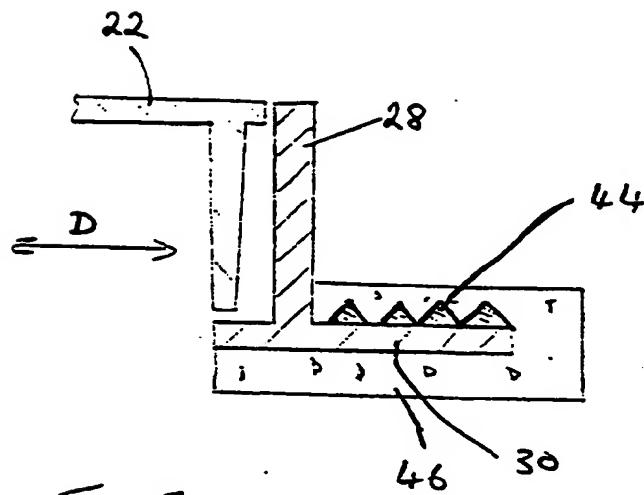


FIG. 5

### A FRAME FOR A MANHOLE COVER

This invention relates to a frame for supporting a manhole cover and to the combination of the frame and manhole cover.

Manhole covers have been known for many years and early examples of such covers are disclosed in UK Patents numbers 27,088 of 1910 and 4221 of 1910, both in the name of Samuel Henry Adams, and documents cited therein. The Adams manhole covers employ generally circular frames which have curved or sloping flanges around the upper end of the frame, the sloping flanges being intended to present an inclined surface, rather than an abrupt edge, as the road material around the manhole erodes away during use. The flanges are provided with an array of holes, or ribs, or other protrusions to assist in anchoring the frame in the road surface and to increase the durability of the road surface in which the frame is anchored.

More recent examples of manhole covers are the "Chieftain" range of covers manufactured and sold by the present applicants.

Despite the fact that manhole covers have been known and used for a very long time, experience has shown that a large number of installed manhole units fail in service due in large part to failure of the bedding material (e.g. bedding mortar) anchoring the frame of the manhole unit in place. It is understood that in excess of £200 million is spent in the UK alone each year in replacing such failed units and it will be appreciated therefore that providing a manhole cover unit which can be firmly anchored

in place and remains thus anchored even under heavy traffic loads represents a substantial problem.

Research carried out by the applicants has shown that the failure of manhole units can be attributed to a number of factors. It has been shown for example that the bending of the corners of manhole frames under traffic loadings causes increased levels of strain in the bedding mortar used to anchor the frames in place, and is a major cause of mortar failure. Another significant cause of mortar bedding failure has been found to be the severe forces created by vehicles braking over the manhole units, causing the whole manhole unit (frame and cover) to be displaced in the direction of vehicle movement. In general, the applicants have found that significant tensile strains are experienced by the manhole units under normal traffic loading and that these strains are in excess of the capabilities of normal cementitious mortars.

It is an object of the present invention to provide a manhole unit, and in particular a manhole frame which has a greatly improved capability for withstanding the tensile strains created by traffic loads, and in particular which is capable of being more firmly anchored in place.

It has been found that by providing reinforcement, such as ribbing, at the corners of the manhole frame, the rigidity and resistance to bending is substantially increased and that this greatly increases the ability of the unit when installed to resist mortar failure. It has also been found that the increased cement-to-metal surface area provided by the ribbing greatly increases resistance to tensile load and enhances the strength of the bedding of the manhole frame.

Accordingly, in a first aspect, the invention provides a frame for supporting a manhole cover; the frame comprising an upstanding peripheral wall; support means extending inwardly from at least part of the wall for

supporting a manhole cover; and an outer flange extending outwardly from a lower part of the wall for anchoring the frame in the ground; the outer flange having disposed over an upper surface thereof a plurality of protrusions or recesses for enhancing the anchoring of the flange and stiffening the frame against bending.

The frame can be of any shape or size and can for example be circular or non circular in form. Typically the frame has corners and most preferably the frame is rectangular.

The reinforcing protrusions or recesses are preferably defined by a plurality of elongate ribs, since these serve to increase the stiffness of the frame and increase its resistance to bending, particularly when disposed at the corners of a frame. The presence of such reinforcing protrusions or recesses at the corners of the frame has been found to be particularly important with rectangular frames. The protrusions or recesses (e.g. ribs) can be present solely at or adjacent the corners of the frame, or they can be disposed around the entire periphery of the frame. Preferably however they are present only in the regions of the corners of the frame. The ribs are preferably substantially parallel, and a central one of said array of ribs may be oriented towards the centre of the frame. For example, when the frame is rectangular, the ribs can be aligned in a diagonal direction with respect to the corners of the frame.

The outer flange of the frame preferably has a plurality of wider regions interspersed with a plurality of narrower regions. When the frame has corners, for example when it is rectangular, the wider regions of the outer flange are disposed at the corners of the frame, thereby serving to further stiffen the frame against bending. This is important since loading tends to be concentrated at the corners of the frame. Typically, at least the surfaces of the wider regions of the outer flange have a plurality of protrusions or recesses (e.g. elongate ribs) disposed thereon.

It has also been found that the grout holes present in known manhole unit frames, which are intended as a means of anchoring the frame into the bedding mortar, actually increase the stress within the mortar. Therefore, it is most preferred that the frame contains no such grout holes or, if grout holes are present, that they be located away from the corners.

In a particularly preferred embodiment, the invention provides a frame for supporting a manhole cover; the frame comprising a rectangular upstanding peripheral wall; support means extending inwardly from the wall for supporting a manhole cover; and an outer flange extending outwardly from a lower part of the wall for anchoring the frame in the ground; the outer flange having wider regions at the corners thereof and narrower regions between the corners, each of the wider portions having an array of substantially parallel elongate ribs on the upper surface thereof for enhancing the anchoring of the frame in the ground and for stiffening the frame at the corners.

In another aspect, the invention provides a manhole cover assembly comprising a frame as hereinbefore defined, and a manhole cover configured so as to be supported in a seat defined by the peripheral wall and the support means.

The invention also provides a manhole installation comprising a manhole having a layer of bedding material surrounding the mouth thereof, a frame as hereinbefore defined being set into the bedding material, the outer flange being substantially completely covered by the bedding material, and the protrusions or recesses serving to enhance the anchoring of the frame in the bedding material; and a manhole cover removably mounted in the frame.

The bedding material can be, for example, a mortar or a combination of mortar and a "backfill" material such as asphalt or similar materials. The



outer flange can be substantially completely surrounded by mortar, or it can be set into a layer of mortar and a layer of backfill material compacted on top of the flange.

The invention will now be illustrated, but not limited, by reference to the specific embodiments shown in the accompanying drawings in which:

Figure 1a is a plan view of a known type of manhole cover frame;

Figure 1b is a sectional elevation along line I-I in Figure 1a;

Figure 2 is a plan view of a manhole unit comprising a manhole cover and frame in accordance with one embodiment of the invention;

Figure 3 is a fragmentary view showing one corner of the frame of the manhole unit of Figure 2;

Figure 4 is a fragmentary view showing one corner of the frame of a manhole unit according to another embodiment of the invention; and

Figure 5 is a schematic sectional elevation illustrating a portion of the manhole unit of the invention embedded in mortar.

Referring now to the drawings, Figures 1a and 1b illustrate a known type of manhole cover frame 2 of rectangular form. The frame 2 comprises an upstanding peripheral wall 4 from the lower end of which extends an outer flange 6 which is of substantially uniform width. Outer flange 6 has a relatively low upturned rim 8 at its outermost extent and has a number of webbing elements 10 linking the rim 8 with the upstanding peripheral wall 4 to provide reinforcement thereto. In order to provide a means of supporting a manhole cover (not shown), inner ledges 14 and 18 extend part way round the inner side of the wall 4.

Frames of the type shown in Figures 1a and 1b in use can be set into a bed of mortar surrounding a manhole such that either the outer flange 6 is wholly contained within the mortar, or such that the flange rests on a layer of mortar and a layer of backfill material such as asphalt is compacted on top of the flange. An array of eight elongate holes 12, known as grout holes, are spaced around the outer flange 6, their function being to provide a means of keying the flange into the surrounding mortar bed to hold the frame in place.

Research has shown that frames of the type shown in Figures 1a and 1b can break loose from the anchoring layer of mortar as a result of the stresses and strains caused by vehicle loads on the manhole unit and particularly the tensile strains set up by vehicles braking over the manhole unit. Although the tensile strains are not particularly high, the mortar materials have little tensile strength and so the strains relative to the material strength are significant. The bending of the corners of the frame under the forces imposed by vehicles passing over the manhole unit leads to increased levels of stress within the mortar, and ultimately causes the mortar to break away from the outer flange. The problem is exacerbated, rather than alleviated by the grout holes 12.

Figures 2 to 5 illustrate improved manhole cover frames in accordance with the invention. As shown in Figure 2, the manhole assembly comprises a frame 20 and a pair of manhole covers 22 which are of a generally triangular shape. Keyholes 24 are provided in each cover 22 for engagement with a tool for lifting the covers.

The frame 20 is of rectangular form and has four corners 26. The frame comprises an upstanding peripheral wall 28, from the lower edge of which a flange 30 extends outwardly. Flange 30 has wider portions 32 at the corners 26 and narrower portions 34 between the corners. At spaced intervals around the perimeter of the flange, webbing elements 36, 38

extend between the flange 30 and the wall 28 to provide reinforcement.

Ledges 40, 42 extend inwardly of the peripheral wall 28 to provide a means of supporting the covers 22. The ledges can be ribbed and can span the inner corners of the wall 28, as shown in Figure 4, or they can be of a non-ribbed form and of generally uniform width as shown in Figure 3. It will be appreciated however that the ledges for supporting the manhole covers need not have the shapes shown but can take any of a wide variety of different shapes.

At each of the corners of the frame, the wider portions 32 of the flange are reinforced by means of arrays of aligned substantially parallel ribs 44 which are oriented in a generally diagonal direction. Ribs 44 perform several functions. Firstly they serve to reinforce the corners to provide a stiffening effect to improve the resistance of the frame to bending and distortion under the weight of road traffic. Secondly, the ribs increase the surface area over which the flange is in contact with the mortar 46 (or combination of mortar and backfill material) into which the frame is embedded in use. This latter effect is shown more clearly in Figure 5. It will be noted that in Figure 5, the flange 30 is shown as being wholly embedded in the bedding mortar. However, alternatively, the flange could be set into a layer of mortar and a layer of backfill material such as asphalt compacted onto the top surface of the flange as previously indicated.

The ribs 44 thus enable the flange to be retained more securely in the mortar and this means that the frame is better able to withstand the forces (represented by the double headed arrow D in Figure 5) created by vehicles braking on the manhole covers 22.

It will also be noted that the flange 30 lacks the grout holes of the known manhole frame shown in Figures 1a and 1b, and the absence of the grout holes removes another source of stress in the mortar 46.

In the embodiment shown in Figures 2,3 and 5, the ribs 44 are formed as raised projections from the upper surface of the flange. In an alternative embodiment, as shown in Figure 4, the ribs can be defined by a series of elongate recesses 48, the surfaces 50 of the flange between the recesses 48 defining the ribs. This embodiment shares with the embodiment of Figures 2, 3 and 5 the advantage of the improved bonding of the frame to the bedding mortar but is not reinforced to the same extent as the embodiment of Figures 2, 3 and 5 and for this reason is less preferred.

It will readily be apparent that numerous alterations and modifications could be made to the manhole cover frames illustrated in the attached drawings without departing from the principles underlying the invention and all such alterations and modifications are intended to be embraced by this application.

**CLAIMS**

1. A frame for supporting a manhole cover; the frame comprising an upstanding peripheral wall; support means extending inwardly from at least part of the wall for supporting a manhole cover; and an outer flange extending outwardly from a lower part of the wall for anchoring the frame in the ground; the outer flange having disposed over an upper surface thereof a plurality of protrusions or recesses for enhancing the anchoring of the flange and stiffening the frame against bending.
2. A frame according to claim 1 wherein the protrusions or recesses are defined by a plurality of elongate ribs.
3. A frame according to claim 1 or claim 2 wherein the outer flange is provided with a plurality of spaced apart regions, each of the regions having disposed thereon a plurality of protrusions or recesses.
4. A frame according to claim 3 wherein each region has an array of aligned substantially parallel ribs.
5. A frame according to claim 4 wherein a central one of said array of ribs is oriented towards the centre of the frame.
6. A frame according to any one of the preceding claims wherein the upstanding peripheral wall has one or more corners, and the outer flange is provided with a plurality of protrusions or recesses at least at the corner(s).
7. A frame according to claim 6 wherein the upstanding peripheral wall is in the form of a rectangle.

8. A frame according to claim 7 wherein each corner of the rectangle is provided with an array of diagonally oriented substantially parallel ribs.
9. A frame according to any one of the preceding claims wherein the outer flange has a plurality of wider regions interspersed with a plurality of narrower regions.
10. A frame according to claim 9 wherein the frame has corners, and preferably is rectangular, and the wider regions of the outer flange are disposed at the corners.
11. A frame according to claim 9 or claim 10 wherein at least the surfaces of the wider regions of the outer flange have a plurality of protrusions or recesses disposed thereon.
12. A frame according to any one of the preceding claims wherein the outer flange is substantially free from grout holes.
13. A frame for supporting a manhole cover; the frame comprising a rectangular upstanding peripheral wall; support means extending inwardly from at least part of the wall for supporting a manhole cover; and an outer flange extending outwardly from a lower part of the wall for anchoring the frame in the ground; the outer flange having wider regions at the corners thereof and narrower regions between the corners, each of the wider portions having an array of substantially parallel elongate ribs on the upper surface thereof for enhancing the anchoring of the frame in the ground and for stiffening the frame at the corners.
14. A frame substantially as described herein with reference to the accompanying drawings.

15. A manhole cover assembly comprising a frame as defined in any one of the preceding claims and a manhole cover configured so as to be supported in a seat defined by the peripheral wall and the inner flange.
16. A manhole installation comprising a manhole having a layer of mortar surrounding the mouth thereof, a frame as defined in any one of claims 1 to 14 being set into the mortar, the outer flange being substantially completely covered by the mortar, and the protrusions or recesses serving to enhance the anchoring of the frame in the mortar; and a manhole cover removably mounted in the frame.



**Application No:** GB 9716243.2  
**Claims searched:** 1 - 16

**Examiner:** Matthew Males  
**Date of search:** 22 October 1997

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): E1G

Int Cl (Ed.6): E02D 29/14

Other:

**Documents considered to be relevant:**

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2,291,452 A	Glynwed Foundry Products Limited (page 4, lines 8-13 & lines 25-27; Figure 1).	1, 2, 6, 9 and 12
X	GB 2,080,373 A	British Steel Corporation (page 1, lines 56-64; Figure 1).	1
X	GB 1,162,434	Brickhouse Foundry Limited (page 1, lines 57-70; Figure 1).	1, 6, 7 and 12
X	US 5,240,346	Chun-Chou Yin (Figure 8).	1, 6 and 7

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.